

APPLICATION FOR UNITED STATES PATENT

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INVENTION: Modular Block Assembly for Tufting Machine

SPECIFICATION

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1 **MODULAR BLOCK ASSEMBLY FOR TUFTING MACHINE**

2 **FIELD OF THE INVENTION**

3 **[0001]** The present invention relates to a tufting machine
4 with replaceable self-aligning gauge modules and is more
5 particularly concerned with a gauge module with individually
6 replaceable gauge elements which can be readily installed and
7 removed.

8
9 **BACKGROUND OF THE INVENTION**

10 **[0002]** Tufting machines are built with precision so that
11 the needles and loopers of the machine are accurately spaced from
12 each other along the needle bar or looper bars. The loopers and
13 needles must be spaced from each other so that the looper bills
14 pass closely adjacent to the needles to engage and hold loops of
15 yarns carried by the needles. When assembling a tufting
16 apparatus, errors in positioning these gauge elements may
17 accumulate as the work progresses. The present invention seeks
18 to establish consistency with these parts across the width of the
19 apparatus, to provide a tufting environment, suitable even for
20 narrow gauge configurations. The present invention also
21 addresses the problem of replacing individual gauge elements that
22 become broken or damaged during tufting. In most modular
23 designs, a broken gauge element requires discarding the entire
24 modular block containing a set of about one to two dozen gauge

1 elements. The present invention allows for quick and efficient
2 replacement of individually damaged gauge elements.

3 **[0003]** The idea of replacing individual components of
4 assemblies in tufting machines is not new. In the past, knife
5 holder assemblies have been devised that allow for the
6 replacement of individual knives. The knives were arranged in
7 pre-assembled or modular fashion in a knife holder, each knife
8 holder having a guide mechanism which enables the knives, as a
9 group, to be positioned on a carrying member of a tufting machine
10 and maintained in appropriate alignment. U.S. Pat. Nos.
11 4,608,934; 4,669,171; 4,691,646; and 4,693,191 illustrate such
12 prior art knife holder assemblies in which parallel knives are
13 disposed in juxtaposition in guide bars which are provided with
14 guides for guiding and then clamping them in appropriate
15 positions on a tufting machine.

16 **[0004]** Needles have previously been individually secured
17 in modular gauge blocks as shown in U.S. Patent No. 4,170,949,
18 and hooks and knives have also been individually secured in gauge
19 parts mounting blocks as shown in U.S. Patent No. 4,491,078.
20 These designs have used individual clamping screws to hold each
21 gauge element in place. These blocks were not mated with slots
22 on the carrying members and were heavily machined.

23 **[0005]** More recently attempts have been made to
24 incorporate needles and loopers into replaceable modular

1 assemblies. U.S. Pat. Nos. RE37,108, 5,896,821, 5,295,450
2 illustrate such modular gauge assemblies in which the gauge
3 elements are permanently embedded into the modular block. The
4 block is attached to the guide bar with a single screw allowing
5 for removal and replacement of the block. One shortcoming of
6 these modular assemblies is that when a single gauge element
7 breaks the entire modular assembly must be discarded.

8 SUMMARY OF THE INVENTION

9 [0006] The present invention includes a modular gauge
10 assembly that attaches to a gauge bar. The gauge bar has a
11 plurality of positioning recesses that allows a detent on an
12 individual modular block to be accurately positioned along the
13 gauge bar. Each modular block typically includes a front
14 surface, a pair of side surfaces opposed to each other, a rear
15 surface opposite to the front surface, and a bottom surface. A
16 tongue, which may or may not be a part of the cast block extends
17 from a bottom or bottom surface of the modular block. The tongue
18 includes a threaded hole which along with a securing screw serves
19 to mount the block to a gauge bar. The threaded hole aligns with
20 the gauge bar receiving hole when the tongue of the modular block
21 is positioned properly with a recess on the gauge bar. When
22 sufficiently tightened, the securing screw holds the modular
23 block to the gauge bar. At least the front surface contains a
24 plurality of spaced parallel slots so that gauge elements may be

1 positioned in the slots with proper spacing in the block. The
2 proximal ends of the gauge elements have apertures recessed
3 therein. The proximal ends of the gauge elements are inserted
4 into the block and secured there by a securing pin that enters
5 the block on one of the opposing side surfaces and passes through
6 the apertures on the proximal ends of the gauge elements.
7 Individual gauge elements can be replaced by demounting the
8 affected block, removing the securing pin and removing the
9 selected gauge element. After the selected gauge element is
10 removed a new gauge element may be re-inserted into the proper
11 vertical slot and secured by the securing pin.

12 **[0007]** A plurality of modular blocks are arranged along
13 the surface of the gauge bar and are vertically positioned on the
14 gauge bar by a horizontal surface on the gauge bar or on a guide
15 bar that passes through a guide bar channel on the gauge bar.
16 The width of each block is equal to the distance between the
17 positioning recesses of the gauge bar so that the edges of the
18 blocks abut one another and the blocks are laterally positioned.

19 **[0008]** In an alternative embodiment of the present
20 invention the modular gauge assembly attaches to a gauge bar
21 having a plurality of positioning recesses that allows the detent
22 on an individual modular block to laterally position the block on
23 the gauge bar. Each modular block typically includes a front
24 surface, a pair of side surfaces opposed to each other, a rear

1 surface opposite to the front surface, and opposing bottom and
2 top surfaces. The rear surface contains a rectangular tab or
3 detent that includes a threaded hole to receive a securing screw.
4 The threaded hole aligns with the gauge bar receiving hole when
5 the modular block is positioned properly on the gauge bar. When
6 tightened, the securing screw holds the modular block securely to
7 the gauge bar. A plurality of gauge holes extend from the bottom
8 toward the top surface, in some cases passing through the modular
9 block. Gauge elements with proximal ends adapted to be received
10 within the gauge holes may be positioned with proper spacing in
11 the block. Gauge elements that have the proximal end inserted
12 into the block are securely positioned pin-screws that enter the
13 block below the tab on the rear surface. The pin-screws are
14 positioned beneath the tab. In this fashion, the pin-screws can
15 be accessed without removing the modular block from the gauge
16 bar.

17 **[0009]** Accordingly, it is an object of the present
18 invention to provide a tufting machine where the gauge elements
19 of the tufting machine are accurately positioned within a modular
20 block assembly.

21 **[0010]** Another object of the present invention is to
22 provide in a tufting machine, a system which can facilitate the
23 rapid change over of one or more damaged gauge elements, reducing
24 to a minimum the downtime of the tufting machine.

1 **[0011]** Another object of the present invention is to
2 provide in a modular block assembly, a system which can
3 facilitate the rapid change over of individual damaged gauge
4 elements, reducing the cost of repairing broken gauge elements
5 and removing the need to replace entire modular blocks when a
6 single gauge element becomes damaged.

7 **[0012]** Other objects, features, and advantages of the
8 present invention will become apparent from the following
9 description when considered in conjunction with the accompanying
10 drawing wherein like characters of reference designate
11 corresponding parts throughout several views.

12 **BRIEF DESCRIPTION OF THE DRAWINGS**

13 **[0013]** Figure 1 is a fragmentary perspective view of a
14 modular block assembly with single looper modular blocks in place
15 on a gauge bar.

16 **[0014]** Figure 2 is an exploded perspective view of
17 modular block assembly of Figure 1 with modular blocks removed
18 from the gauge bar, and one single looper modular block
19 disassembled.

20 **[0015]** Figure 3 is a perspective view of the rear surface
21 of a modular block of Figure 1.

22 **[0016]** Figure 4 is a fragmentary perspective view of a
23 double looper modular block assembly with the modular blocks in
24 place on the gauge bar.

1 **[0017]** Figure 5 is an exploded perspective view of the
2 modular block assembly of Figure 4, with modular blocks removed
3 from the gauge bar and one block disassembled.

4 **[0018]** Figure 6 is a fragmentary perspective view of a
5 modular needle block assembly with the modular blocks in place on
6 a gauge bar.

7 **[0019]** Figure 7 is an exploded fragmentary perspective
8 view of the modular needle block assembly of Figure 6 with the
9 modular blocks removed from the gauge bar and one block
10 disassembled.

11 **[0020]** Figure 8 is a rear perspective view of a modular
12 block of Figure 6.

13 **DETAILED DESCRIPTION**

14 **[0021]** The present invention is utilized in a tufting
15 machine of the type generally including a needle bar carrying one
16 or more rows of longitudinally spaced needles and which is
17 supported and reciprocally driven by a plurality of push rods.
18 In the tufting zone, the needles carry yarns which are driven
19 through a backing fabric by the reciprocation of the needles.
20 While penetrating the backing fabric, a plurality of
21 longitudinally spaced hooks cooperate with the needles to seize
22 loops of yarns and thereby form the face of a resulting fabric.
23 In some cases the hooks will cooperate with knives to cut the
24 loops of yarn seized on the hooks and thereby form a cut pile
25 face for the fabric. The present invention is directed to

1 modular units for holding loopers or hooks and for holding
2 needles to facilitate their cooperation during the tufting
3 process.

4 **[0022]** Referring in detail to Figure 1, a modular block
5 assembly 5 is illustrated having a single row of gauge elements
6 10, in this case loopers, housed in the modular blocks 15. The
7 individual gauge elements 10 are fastened to the block 15 by
8 securing pin 20. As better illustrated in Figure 2, the securing
9 pin 20 enters the modular block 15 at one of the opposing side
10 surfaces 22a, 22b. The gauge bar 25 and guide bar 30 are used in
11 concert to position the individual modular blocks 15 relative to
12 one another. The guide bar 30 slides laterally through channel
13 35 substantially the entire length of the gauge bar 25, and
14 engages tab breaks 115 of the modular blocks 15, as shown in
15 Figure 3, to vertically align the individual blocks 15.

16 **[0023]** Figure 2 illustrates a portion of the modular
17 block assembly 5 with the blocks 15 detached from the gauge bar
18 25. The gauge bar 25 has a plurality of vertical recesses 40.
19 The recesses 40 are crossed by lateral channel 35 so that guide
20 bar 30 fits between the gauge bar 25 and the rear surfaces 45 of
21 the modular blocks 15. Guide bar 30 creates upper face 31 and
22 lower face 32 which are normal to the side walls of recesses 40.

1 Theses faces 31, 32 serve as restraining surfaces. One modular
2 block 15 in Figure 2 is disassembled and removed from the gauge
3 bar 25 to reveal the spaced parallel slots 50 divided by vertical
4 walls 51 located on the front surface 55 of the block for
5 receiving the proximal ends 75 of the gauge element 10. The
6 proximal ends 75 of the gauge elements 10 contain apertures such
7 as pin holes 70. When the gauge elements 10 are positioned in
8 the modular block 15, the pinholes 70 align with apertures formed
9 in side surfaces of the block such as pin opening 85. Securing
10 pin 20 is then inserted through the pin opening 85 in one of the
11 opposing side surfaces 22a, 22b, and the pin opening 85 for each
12 gauge element 10 to fasten the gauge elements 10 to the block 15.
13 In modular blocks 15 containing only a single row of gauge
14 elements 10, a tongue portion 60 extends from the rear surface 45
15 of the modular block 15. The tongue 60 forms the detent. The
16 tongue 60 has an opening 90, as shown in Figure 3, preferably in
17 the form of a threaded hole which aligns with another hole 100,
18 located in a gauge bar recess 40, when the modular block 15 is
19 positioned on the gauge bar 25. Once a modular block 15 is
20 positioned a securing screw 65 can be inserted through the
21 opening 90 and tightened into the hole 100 on the gauge bar. A
22 modular block 15, once fixed in place by the securing screw 65,

1 is prevented from lateral and vertical movement. The screw 65
2 and vertical recesses 40 resist against horizontal movement while
3 the screw and faces 31,32 of the guide bar 25 resist against
4 vertical movement. The fixed position of the blocks 15 insures
5 that the gauge elements 10 remain properly aligned during the
6 tufting process.

7 [0024] Figure 3 shows the rear surface 45 of a modular
8 block 15 having a single row of gauge elements 10. On the rear
9 surface 45 is an elongated tab 110 that extends vertically from
10 the top 165 of the block to the bottom of the tongue portion 60
11 of the block. The tab 110 has a horizontal break 115 which as
12 previously described engages with guide bar 30 to vertically
13 position block 15 on the gauge bar 25. The walls of break 115
14 are preferably substantially planar and parallel so that a part
15 of the rectangular cross section of guide bar 30 closely fits
16 within the break. The lower segment of the tab 120 contains the
17 opening 90 where the securing screw 65 enters and attaches to a
18 receiving hole 100 in the gauge bar.

19 [0025] Figure 4 illustrates a modular block assembly 5
20 having three double gauge element modular blocks 130 mounted on
21 the gauge bar 26. Each modular block 130 contains two gauge
22 element rows 125. Modular blocks 130 have two apertures such as

1 pin openings **85a**, **85b** that are spaced apart on the side surfaces
2 **22a**, **22b** of the block **130**. Unlike single gauge element blocks
3 **15**, a portion of the double gauge modular blocks **130** rests on top
4 of the gauge bar **26** to vertically position blocks **130**. This is
5 accomplished by pushing the tongue **60** forward to the center of
6 the bottom of the block **135**.

7 **[0026]** Figure 5 shows an exploded view of modular block
8 **130** containing two rows **125** of gauge elements **11**, **12**. The gauge
9 bar **26** in Figure 5 has a plurality of vertical recesses **40**.
10 Vertical recesses **40** receive tongues **60** to horizontally position
11 blocks **130** along the gauge bar **25**. Vertical positioning is
12 accomplished by resting part of the bottom surface of gauge
13 blocks **130** on the top surface of gauge bar **25**. The modular block
14 **130** in Figure 5 is disassembled and removed from the gauge bar **26**
15 to reveal the spaced parallel slots **50a**, **50b** located on the front
16 **55** and rear surface **45** of the block **130** for receiving the
17 proximal ends **75**, **78** of the gauge elements **11**, **12**. The proximal
18 ends **77**, **78** of the gauge elements **11**, **12** contain openings such as
19 pin holes **71**, **72** which when positioned in slots **50a**, **50b** of
20 modular block **130** align with pin openings **85a** or **85b**,
21 respectively. The securing pins **20a**, **20b** are inserted through
22 the pin openings **85a** or **85b** on one of the opposing side surfaces

1 22a, 22b and through pin holes 71, 72 for each gauge element 11,
2 12 to fasten the gauge elements 11, 12 to the modular block 130.
3 In the illustrated modular blocks 130 containing two rows 125 of
4 gauge elements 11, 12 the tongue portion 60 of the modular block
5 130 extends from the center of the bottom surface 135. The
6 tongue 60 defines an opening 90 (not shown) which aligns with
7 receiving holes 100, located in the vertical recesses 40, when
8 the modular block 130 is positioned on the gauge bar 26. Once
9 the modular block 130 is positioned a securing screw 65 can be
10 inserted through opening 90 and tightened into a threaded
11 receiving hole 100. The modular block 130, once fixed in place
12 by the securing screw 65, is prevented from lateral and vertical
13 movement. The fixed position of the block 130 insures that the
14 gauge elements 10 remain properly aligned during the tufting
15 process.

16 [0027] Referring now to Figure 6, another aspect of the
17 present invention depicts a modular block assembly 5 having a
18 single row of gauge elements, in this case needles 13, housed in
19 a clamping modular block 140. Figure 6 shows four clamping
20 modular blocks 140 attached to the gauge bar 27. The clamping
21 modular blocks 140 are positioned such that the lower portion 150
22 of the block 140 extends beneath the gauge bar 27. This exposed

1 lower portion 150 contains the individual clamping elements, such
2 as screw-pins 145, shown in Figure 7, that hold the gauge
3 elements 13 in place in the block 140. The gauge bar 127 has a
4 horizontal shelf portion 27a and a vertical portion 27b which
5 join to form an interior right angle.

6 [0028] Figure 7 illustrates a portion of a modular block
7 assembly 5 with screw-pin modular blocks 140 detached from the
8 gauge bar 25 and one block 140 disassembled. The gauge bar 27
9 has a plurality of vertical recesses 40 imposed on the front of
10 the gauge bar 27. As illustrated, the recesses 40 do not extend
11 the entire height of the wall portion 27b of the gauge bar 27.
12 Each recess contains a preferably threaded hole 100 which
13 receives a securing screw 65 to attach the block 140 to the gauge
14 bar 27. The rear surface of the modular block 45 contains a
15 rectangular tab 160 having an opening 90, shown in Figure 8,
16 which aligns with the hole 100, located in the gauge bar vertical
17 recesses 40. Once the modular block 140 is positioned in the
18 right angle between the shelf portion 27a and wall portion 27b,
19 with tab 160 received in a vertical recess 40, the securing screw
20 65 can be inserted through the corresponding hole 100 in the wall
21 portion 27b into the opening 90 in the rectangular tab 160 and
22 tightened to hold the modular block 140 in place. Once fixed in

1 place by securing screw 65, the modular block 140 is prevented
2 from lateral movement by the action of the tab 160 fitting with
3 the walls of the vertical recess 40, the screw 65, and adjacent
4 blocks 140. Horizontal movement is restored by action of the
5 screw 65 at the bottom of shelf portion 27a of the gauge bar 27.
6 The fixed position of the block 140 insures that the gauge
7 elements 10 remain properly aligned during the tufting process.

8 [0029] Figure 7 also depicts a disassembled clamping
9 modular block 140 thereby revealing the spaced parallel gauge
10 element openings 155 which extend from the top surface 165 to the
11 bottom surface 135 of the block 140. Openings 155 need not
12 extend completely to the top surface 165 for satisfactory
13 operation, however, it is convenient for manufacture. The
14 individual needles 13 are fastened to the block 140 by dedicated
15 clamps such as screw-pins 145 that fix individual gauge elements
16 10 within the block 140. Screw pins 145 enter the block 140 at
17 the rear surface 45 of the block 45 on its lower portion 150.
18 When the block is attached to the gauge bar 25 the screw-pins 145
19 remain accessible so that individual gauge elements 10 can be
20 removed and replaced.

21 [0030] Figure 8 illustrates the top 165 and rear surface
22 45 of the block 140. Gauge element openings 155 can be seen on

1 the top surface 165 of the block 140. The rectangular tab 160
2 for positioning the block 140 on the gauge bar 25 is located
3 centrally on the rear surface 45 of the block 140. The
4 rectangular tab 160 defines the opening 90 which aligns with the
5 holes 100 in vertical recesses 40 and with securing screw 65
6 fixes the block 140 to the gauge bar 27. Openings 170 for screw
7 pins 145 are located horizontally along the lower portion 150 of
8 block 140.

9 [0031] Although a preferred embodiment of the present
10 invention has been disclosed in detail herein, it will be
11 understood that various substitutions and modifications may be
12 made to the disclosed embodiment described herein without
13 departing from the scope and spirit of the present invention as
14 recited in the appended claims.